

WE CLAIM:

1. An acoustic panel for use in the inlet lip portion of a gas turbine nacelle, the panel comprising: (a) a solid back skin; (b) an acoustically permeable front skin; (c) a honeycomb cell structure located between the front skin and back skin; and (d) an ice protection system affixed to the front skin, wherein the ice protection system includes an acoustically permeable and electrically and thermally conductive structure which includes means for connection to an electric power source, and the structure is thermally insulated from the front skin.
2. The acoustic panel of Claim 1, in which the ice protection system includes a low power electronic ice protection system.
3. The acoustic panel of Claim 1, in which the acoustically permeable front skin is perforated.
4. The acoustic panel of Claim 1, in which the honeycomb structure is adhesively bonded to the front skin and the back skin.
5. The acoustic panel of Claim 1, in which the front skin and the back skin are each an aluminum sheet material.
6. The acoustic panel of Claim 1, in which the front skin, back skin and honeycomb cell structure are each a graphite/epoxy laminate.
7. The acoustic panel of Claim 1, in which the ice protection system includes a stainless steel wire mesh adhesively bonded to the outer surface of the front skin.

8. The acoustic panel of Claim 1, in which a permeable, thermally insulating material is located between the electronic ice protection system and the front skin.
9. The acoustic panel of Claim 8, in which the insulating material is adhesively bonded to the outer surface of the front skin, and the electronic ice protection system is adhesively bonded to the insulating material.
10. The acoustic panel of Claim 1, in which a parting strip is located proximate to the nacelle highlight.
11. The acoustic panel of Claim 10, in which the parting strip is an electrified grid material which carries a watt density of up to about 20W/sq. in.
12. The acoustic panel of Claim 1, in which the ice protection system comprises a plurality of sections which extend around the circumference of the inlet lip of the nacelle.
13. The acoustic panel of Claim 12, in which power is supplied selectively or sequentially to the sections.
14. The acoustic panel of Claim 1, in which the panel additionally comprises an inlet section located proximate to the nacelle highlight, and the inlet section is interconnected to a source of heated air.
15. The acoustic panel of Claim 1, in which the ice protection system comprises:
 - (i) an electrode electrically insulated from the nacelle skin; and

- (ii) a DC power source coupled to the electrode and the nacelle skin to generate a DC bias to an interface between ice formed on the external surface of the nacelle skin and the nacelle skin, wherein the DC bias has a voltage which modified the ice adhesive strength selectively as compared to the ice adhesion strength with substantially zero bias voltage at the surface.

16. An inlet lip for an aircraft gas turbine engine nacelle, the inlet lip comprising:

(a) an acoustic panel structure including a solid back skin, an acoustically permeable front skin, and a honeycomb cell structure therebetween; and (b) an ice protection system located on the front skin, wherein the ice protection system includes an acoustically permeable and electrically and thermally conductive structure in electrical connection to an electric power source, and the ice protection system is thermally insulated from the permeable front skin.

17. A method for reducing noise of an aircraft gas turbine engine and minimizing ice formation on a nacelle inlet of the engine, the method comprising:

(a) providing an acoustic panel in the inlet lip portion of the nacelle, wherein the acoustic panel comprises:

- (i) a solid back skin,
- (ii) an acoustically permeable front skin,
- (iii) a honeycomb cell structure located between the front skin and back skin, and

- (iv) an ice protection system affixed to the front skin, wherein the ice protection system includes an acoustically permeable and electrically and thermally conductive structure which includes means for connection to an electrical power source, and the structure is thermally insulated from the front skin; and
 - (b) providing an electric current to the ice protection system.
18. The method of Claim 17, further comprising and providing the ice protection system with a plurality of sections which extend around the circumference of the inlet lip of the nacelle, and providing power selectively or sequentially to the sections.
19. The method of Claim 17, further comprising providing an inlet section proximate to the nacelle highlight, wherein the inlet section is interconnected to a source of heated air, and providing heated air to the inlet section.
20. The method of Claim 17, further comprising providing the ice protection system with
- (a) an electrode electrically insulated from the nacelle skin; and
 - (b) a DC power source coupled to the electrode and the nacelle skin to generate a DC bias to an interface between ice formed on the external surface of the nacelle skin and the nacelle skin, wherein the DC bias has a voltage which modified the ice adhesive strength selectively as compared to the ice adhesion strength with substantially zero bias voltage at the surface.

and using the DC power source to provide DC current to the electrode and nacelle skin.